Exercise	1a	1b	2	Total
100%	3	1	4	8
Points				

Name:

Stellar Astrophysics

Homework - Lecture 5 - Radiation

Due date: September 22

1 Diffraction

The diffraction pattern for a single slit is given by

$$I(\theta) = I_0 \frac{\sin^2(\beta/2)}{\beta/2} \tag{1}$$

where $\beta = 2\pi D \sin\theta/\lambda$

a) Using l'Hopital's rule, prove that the intensity at $\theta = 0$ is given by $I(0) = I_0$. L'Hopital's rule says that in case you have a case with f(x)/g(x) and g(x=0) = 0, you can find the solution using

$$\lim_{x\to 0} \frac{f(x)}{g(x)} = \lim_{x\to 0} \frac{f'(x)}{g'(x)} \tag{2}$$

In case also g'(x=0) = 0, you have to apply l'Hopital's rule again.

b) If the slit has an aperture of $1.0\,\mu$m, what angle θ corresponds to the first minimum if the wavelength of the light is 5000Å ? Express your answer in degrees.

2 Blackbody radiation

Consider a model of a star consisting of a spherical blackbody with a surface temperature of 28,000 K and a radius of 5.16×10^{11} cm. Let this model star be located at a distance of 180 pc from Earth. Determine the following for the star:

1. Luminosity
2. Absolute bolometric magnitude
3. Apparent bolometric magnitude
4. Distance modulus

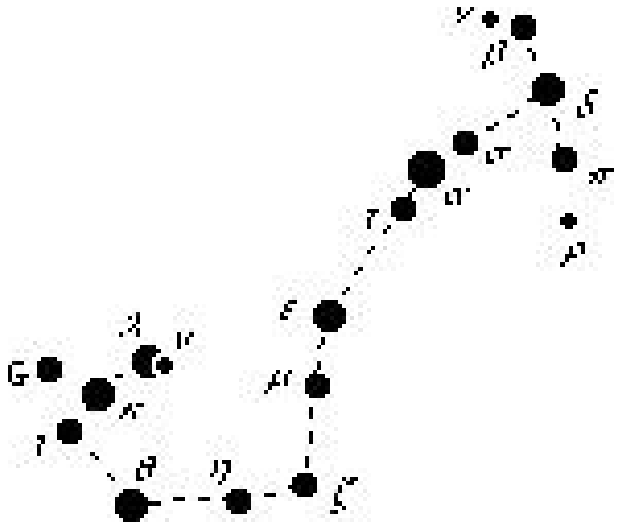

Figure 1: Constellation of Scorpius. δ Scorpii is also called 'Dschubba'. It's position is RA = 15h 54m 25.1s, DEC = -22d 20m 14s.

5. Radiant flux at the star's surface
6. Radiant flux at Earth's surface (compare this with the solar constant)
7. Peak wavelength λ_{max}

This is a model of the B0.3IV star Dschubba, the center star in the head of the constellation Scorpius. In case we have not discussed all the formula you nead in the lecture, look into Carroll & Ostlie, Chapter 3.